

# How California Can Tackle the Duck Curve

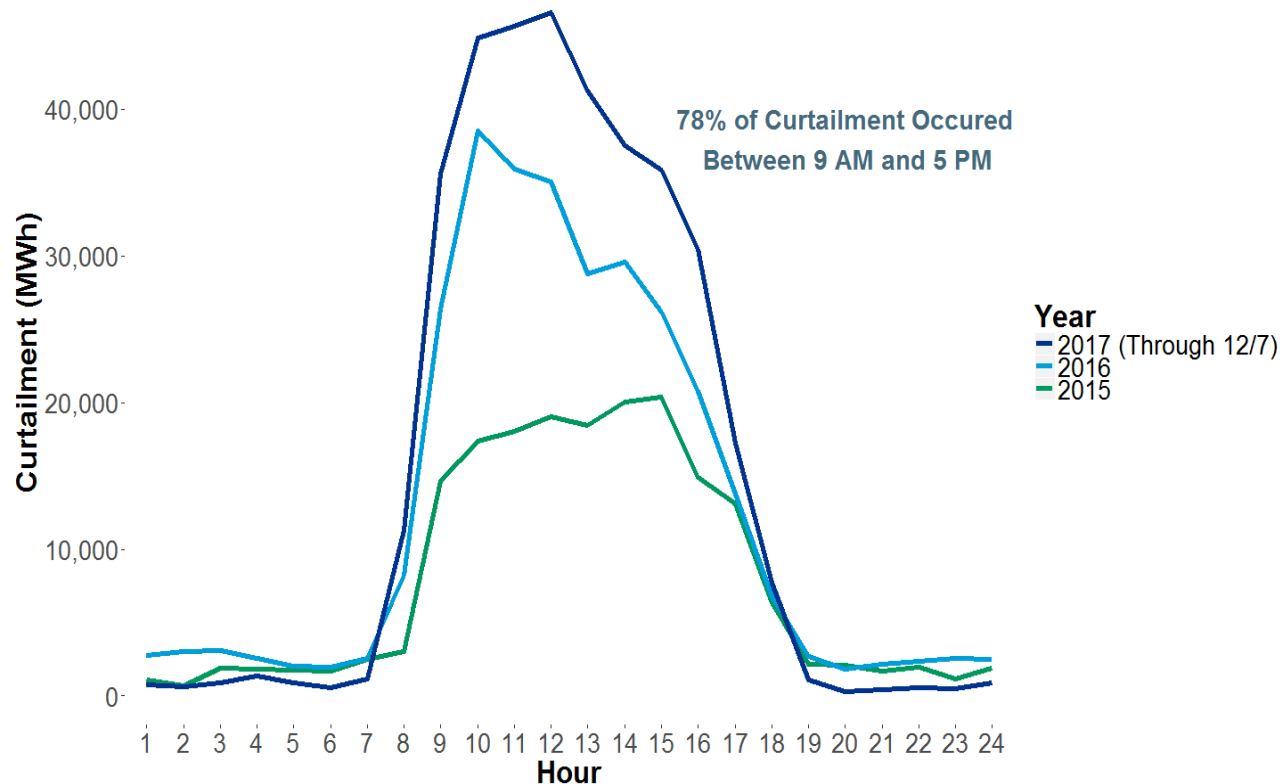
November 24, 2017



Photo source: Bureau of Land Management



# California is wasting renewables

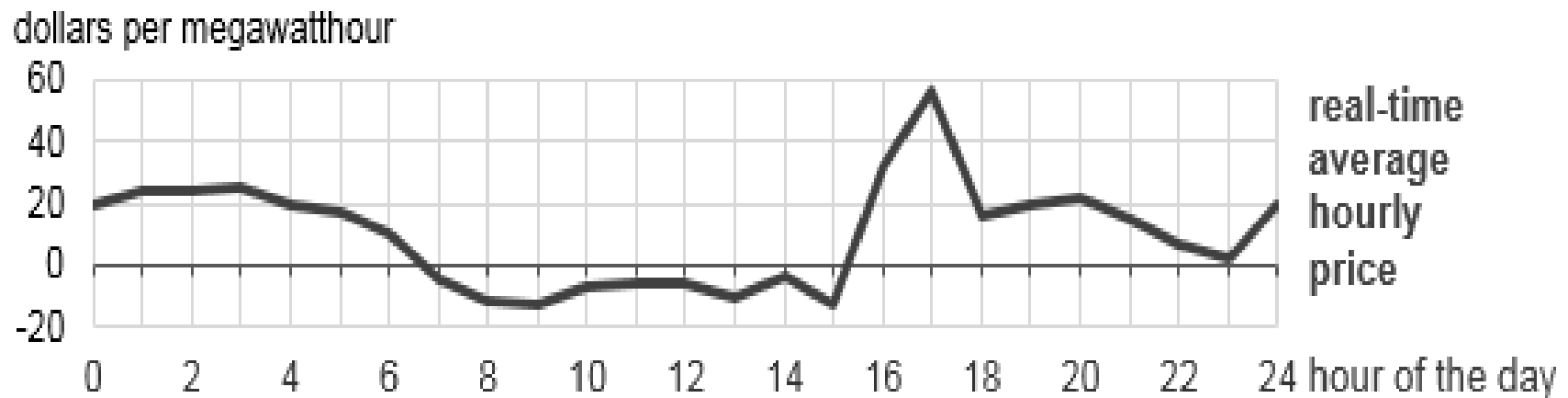
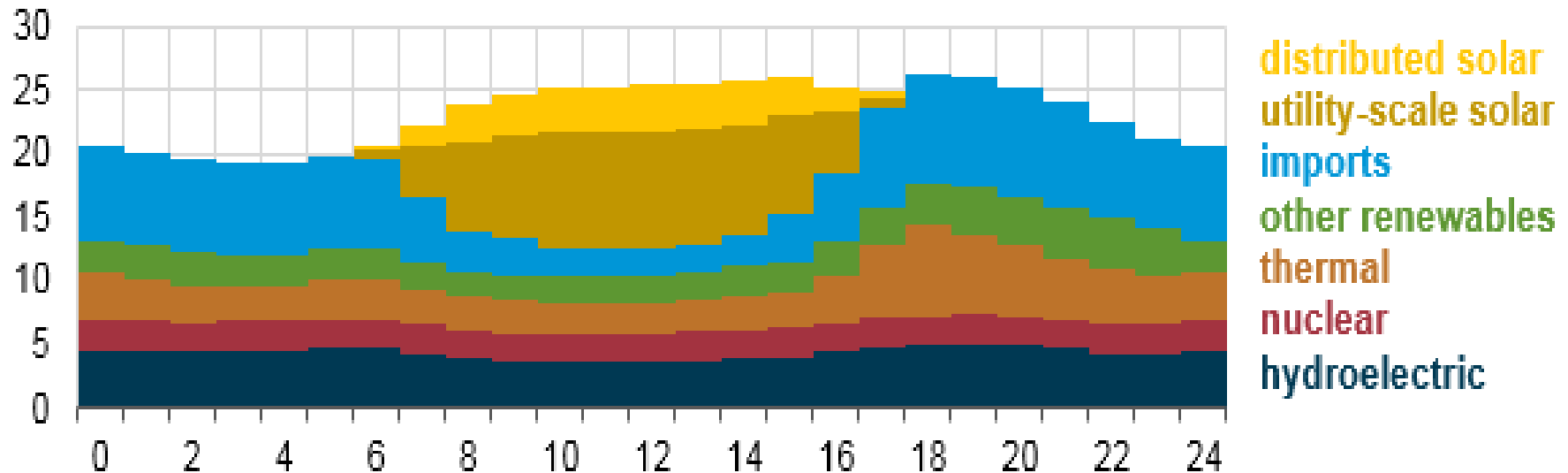


Today's curtailment of renewable generation is wasted zero-emissions electricity

Not on least-cost path to state clean energy goals

# Negative wholesale prices

California Independent System Operator net generation, March 11, 2017  
gigawatthours

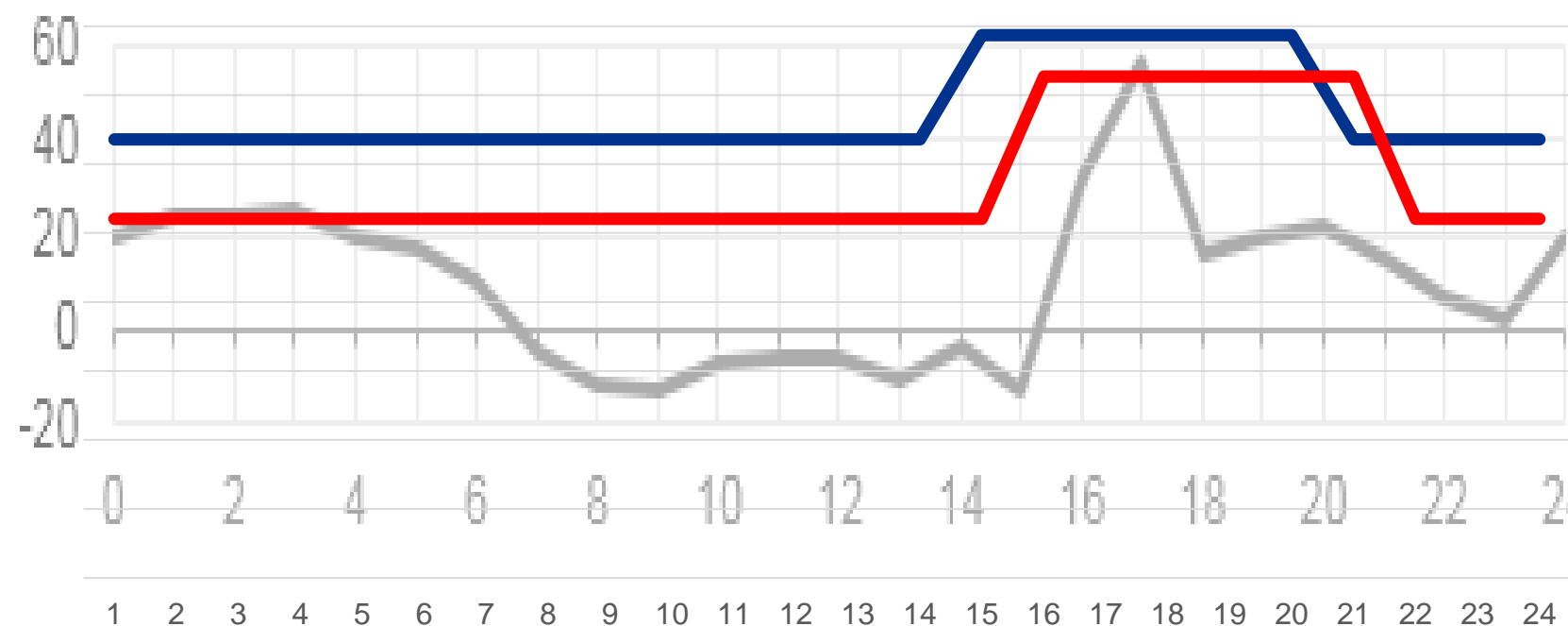


Source: US EIA. *Rising solar generation in California coincides with negative wholesale electricity prices.* Today in Energy. April 11, 2017.

# Retail prices mask wholesale prices

## PG&E's ETOU-A & ETOU-B Experimental Residential Rate

dollars per megawatthour



real-time  
average  
hourly  
price

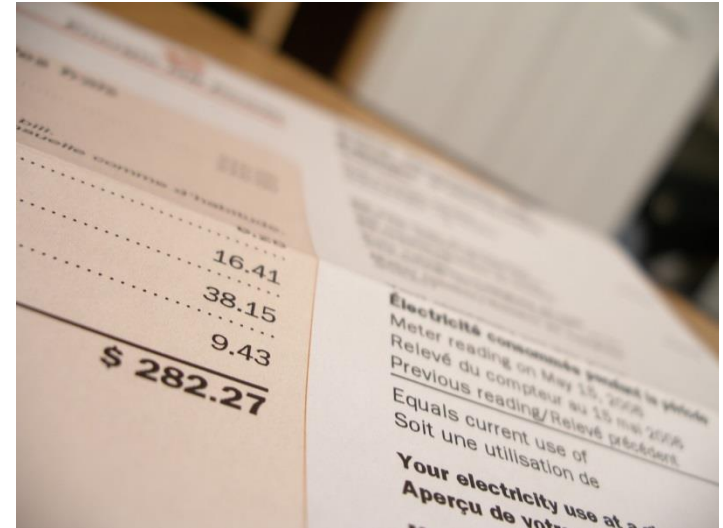
— ETOU-A - Summer (with baseline credit)

— ETOU-B - Summer (no baseline credit)

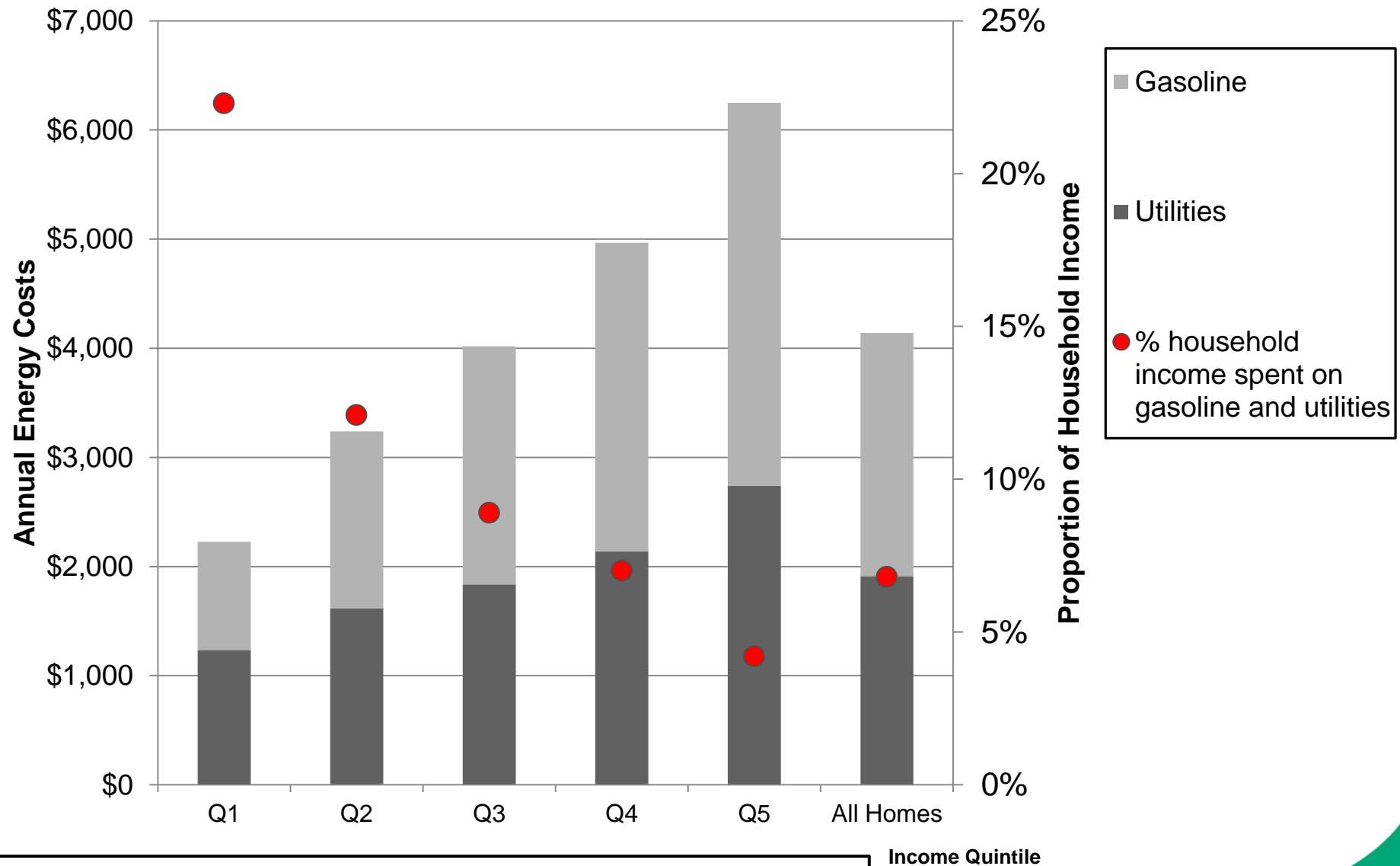
Source: US EIA. *Rising solar generation in California coincides with negative wholesale electricity prices.* Today in Energy. April 11, 2017.

# Smart rate principles

- Utility fees for DER hosting services
- Menu of tariff options, including a Smart Rate
- **Option to buy/sell** to/from the grid
- Tariffs reward DER capabilities
- Regulator creates & oversees a healthy marketplace: information, property rights, enforcement,...



# Access for All with Tailored Solutions



Source: Congressional Budget Office, Memo to Senator Bingaman, June 17, 2008, **Options for Offsetting the Economic Impact on Low- and Moderate-Income Households of a Cap-and-Trade Program for Carbon Dioxide Emissions**. Table 1, Page 3.  
Data from Bureau of Labor Statistics, Consumer Expenditure Survey, 2006, at [www.bls.gov/cex/2006/Standard/quintile.pdf](http://www.bls.gov/cex/2006/Standard/quintile.pdf)





**Thank you**

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# DER Bazaars: New Business Model?

- **De-Risk DER Specters**

- Allow fees for platform services
- Low-transactional costs & regulatory certainty
- Ensure cost recovery
- Most vulnerable rate payers first in line for DER benefits

- **Companion efforts**

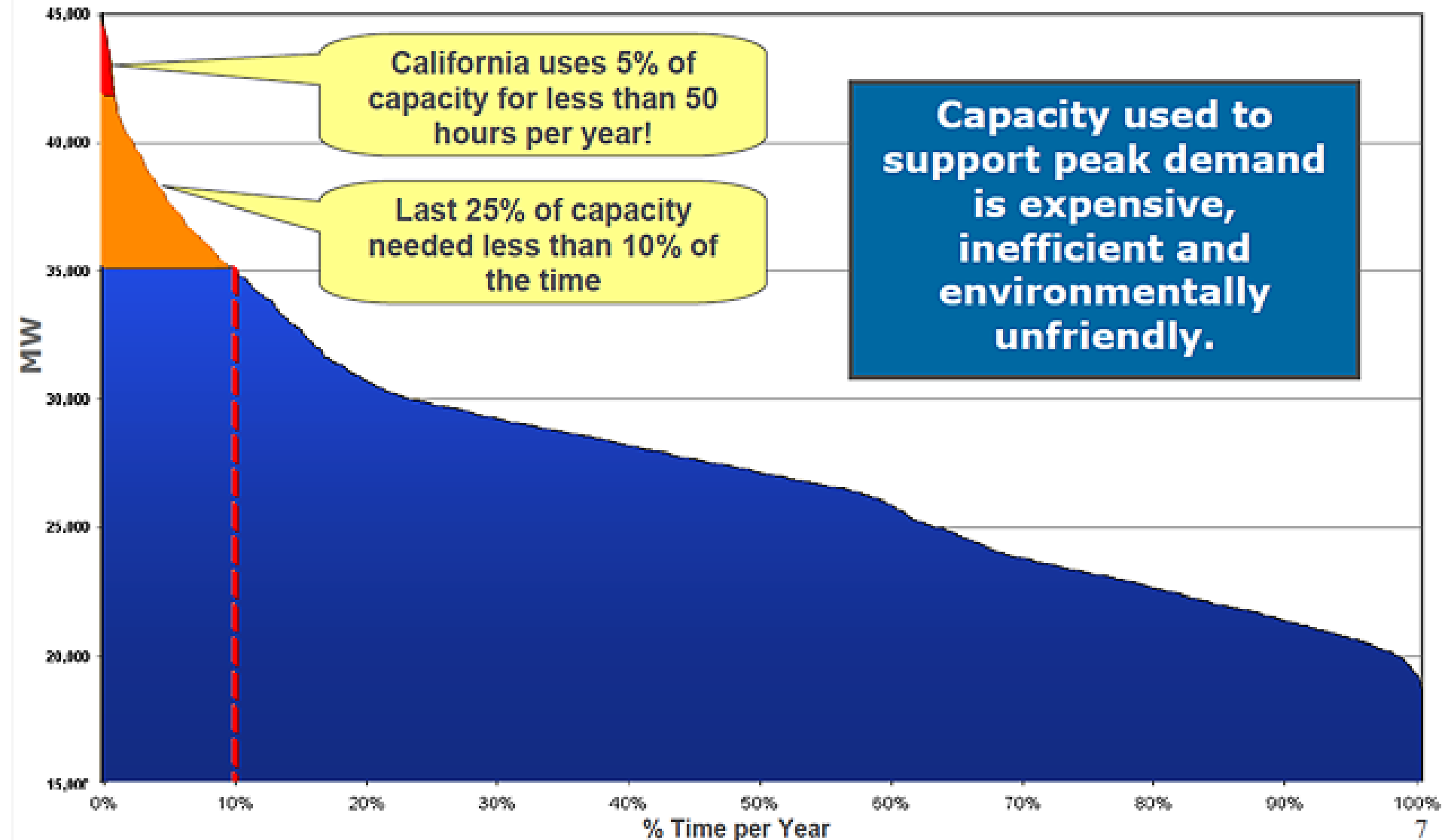
- Wholesale market reform
- Enlightened planning
- DER performance standards



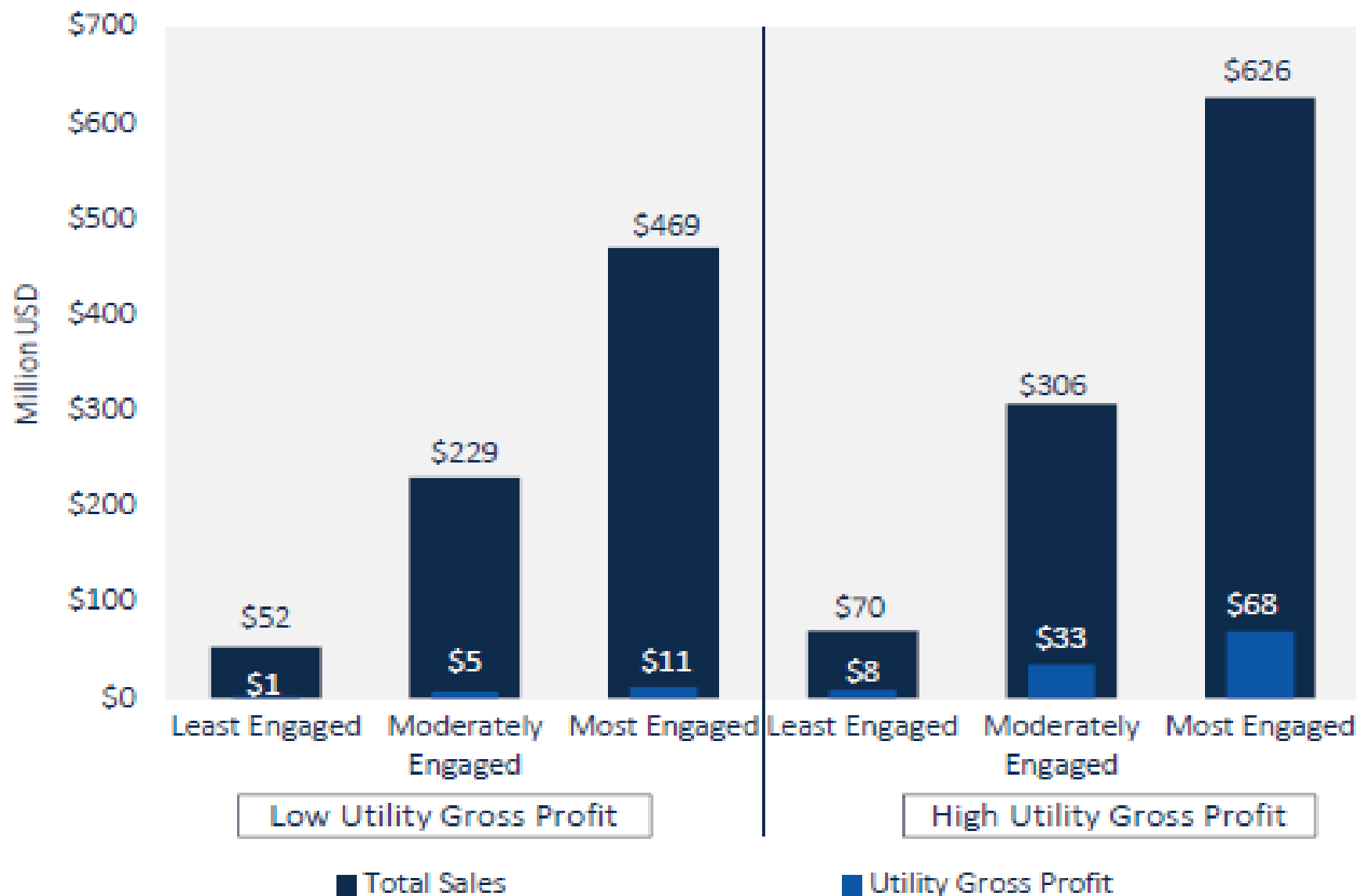


# Yesterday's 100 Hour Problem

System Load Duration Curve



## U.S. DER Marketplace Value Estimate 2017

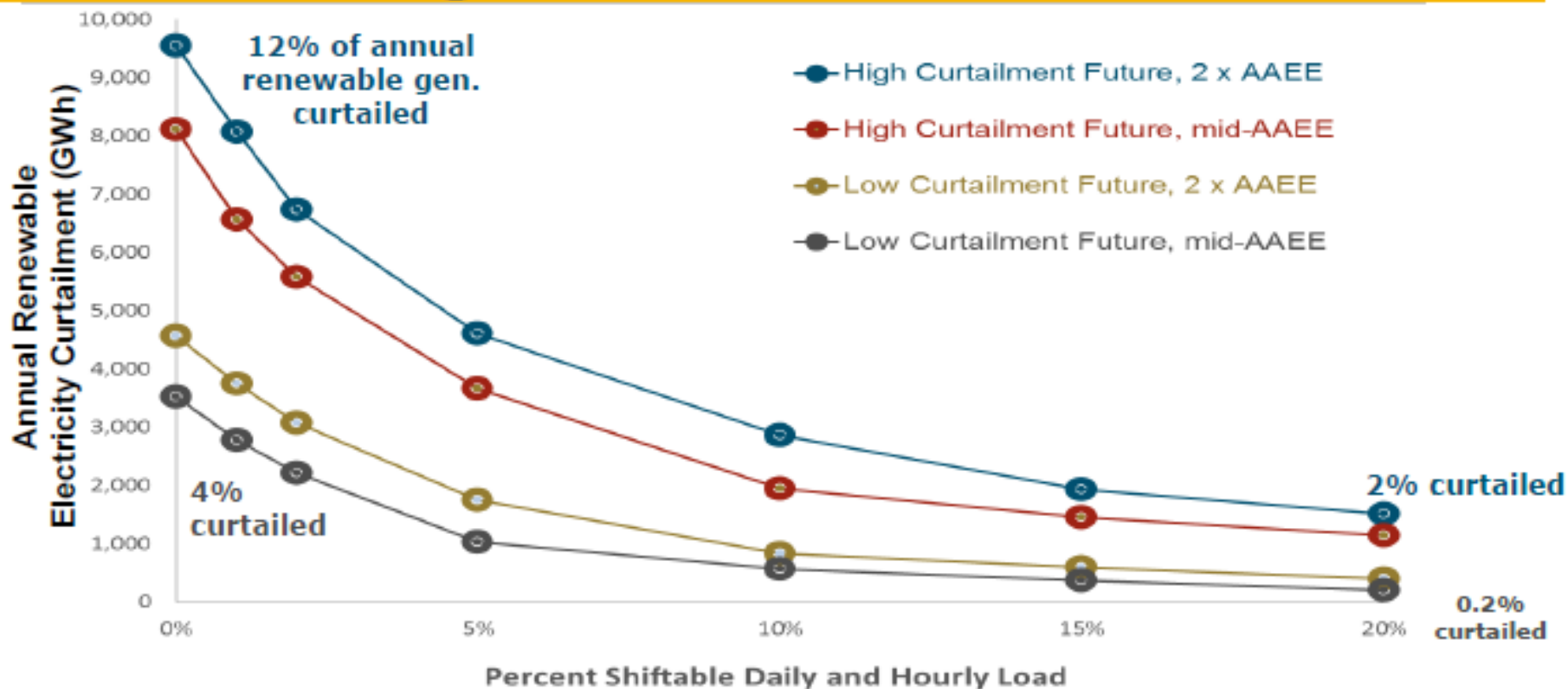


Data source: F. Wang, GTM Research, The Emergence of Utility-Branded DER Marketplaces.. Oct. 2017.

# Shifting DR can Reduce Wasted Clean Energy



## Shift Resources Reduce Curtailment Diminishing Returns as More Load is Shifted



# Risk vs Reward with Time-Variant Rates

